

**PACIFIC NORTHWEST**  
(Washington and Oregon)

**INTERAGENCY OPERATING PLAN**  
**for**  
**VOLCANIC ASH EVENTS**



Mount. St. Helens May 18, 1980



**May 9, 2011**

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## I. Introduction

Volcanic eruption plumes and drifting ash clouds from Pacific Northwest volcanoes have caused delays in flight operations nationwide. Most notably, the May 18, 1980 eruptions of Mount St. Helens, and to a lesser extent subsequent eruptions, have caused delays and potential damage to aircraft and equipment. Volcanic ash also poses a risk to public health and infrastructure. This plan provides an overview of integrated, multiagency efforts to share information and take coordinated action to mitigate the threat of volcanic ash in Washington and Oregon to the nation's aviation system. In addition, distal ash plumes from active volcanoes in Alaska (monitored by Alaska Volcano Observatory (AVO)) and to a lesser extent the Kamchatka Peninsula may cause disruptions in air traffic across the area. A cohesive, well-coordinated response will facilitate the flow of timely and consistent information to those at risk.

The agencies involved in this operating plan are: The Federal Aviation Administration (FAA), the U.S. Geological Survey's (USGS) Cascades Volcano Observatory (CVO), and the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) and National Environmental Satellite, Data and Information Service (NESDIS).

This operating plan is written to cover the States of Washington and Oregon and adjacent Flight Information Regions (FIRs). The Pacific Northwest Interagency Operating Plan for Volcanic Ash Events is an integral part of the NOAA/FAA Volcano Hazards Implementation Plan that supports the Agreement between NOAA and FAA on volcanic hazards. A Letter of Agreement has added volcano hazards support from the USGS to the NOAA/FAA Agreement. As such, this Washington and Oregon plan describes communication links and operational actions necessary to support the NOAA/FAA/USGS Volcano Hazards Implementation Plan. This plan is referenced in the 2007 National Volcanic Ash Operations Plan for Aviation published by the Office of the Federal Coordinator for Meteorological Services (See Appendix C).

Volcanic ash is both a hazard in the air and as it falls to the ground and different agencies have responsibilities for different portions of the hazards. Broader responses to volcanic eruptions in Washington and Oregon from Federal Land Management Agencies, Federal Emergency Management Agency, State/Local/Tribal Emergency Management Agencies and other key stakeholders are addressed in other plans, including National Response Framework driven protocols and the local "ground based plans" that are referenced in Appendix D. Secondly, local offices will execute local emergency response plans (e.g. station duty manuals and standard operating procedures) with the most updated information not included herein. The appropriate primary agencies in this plan (USGS, NOAA, and FAA) will coordinate with their Canadian counterparts if ash

will impact southwest Canada. Furthermore, the Department of Defense's (DOD) role in volcanic ash is covered under the National Volcanic Ash Operations Plan for Aviation and agreements with the FAA. The United States Air Force through its 2<sup>nd</sup> Weather Group, Air Force Weather Agency (AFWA), Offutt Air Force Base, Nebraska, is the DOD focal point for volcanic ash advisories and forecasts. Lastly during non-eruptive periods, ash may become "re-suspended" from previous volcanic eruptions, and these "re-suspended" ash events will be managed by the appropriate agency the same as volcanic ash events.

## **II. Roles and Responsibilities of Partnering Agencies**

### **1. United States Geological Survey (USGS)**

The USGS has the federal responsibility to issue disaster warnings for earthquakes, volcanic eruptions, landslides, or other geologic catastrophes. The USGS provides eruption warnings and related notifications based on data and observations collected from extensive monitoring networks operated by five U.S. volcano observatories supported primarily by the USGS Volcano Hazards Program.

#### **Cascades Volcano Observatory (CVO) – Vancouver WA**

The CVO was created on 18 May 1982 in response to the ongoing eruption of Mount St. Helens. Located in Vancouver, WA, the observatory, in partnership with the University of Washington's Pacific Northwest Seismic Network (PNSN) and the USGS' Northern California Seismic Network (NCSN) has responsibility for monitoring volcanoes - from Mount Baker in northern Washington to Crater Lake in southern Oregon and smaller volcanic centers that lie between them - and to give timely warning about volcanic activity. During periods of quiescence, CVO monitors the volcanoes to watch for signs of unrest and responds to a dozen or so inquiries a year from public officials and the public regarding perceived volcanic activity (for example, reports of ash plumes during hot, dry, windy weather that are related to re-suspension of ash into the atmosphere, not volcanic activity) and provides validation as to whether the perceived activity is real or not. During crises, CVO gives warning as volcanoes ramp up from normal quiescence to eruption and, as importantly, as eruptive activity dies down to background. In addition, the observatory provides short-term forecasts based on the activity.

CVO has three primary objectives:

- To monitor volcanoes in the Cascades to provide accurate and timely information to public officials and the public about volcanic activity.

- To conduct basic research on how volcanoes work, including discerning eruptive histories, in order to assess hazards to communities, interpret monitoring signals and to provide short-term forecasts during periods of unrest and eruption.
- To inform public officials and the public about the hazards associated with volcanic activity.

All three activities are necessary for a successful response.

Cascades Volcano Observatory web site: <http://vulcan.wr.usgs.gov>

Volcano Hazards Program web site: <http://volcanoes.usgs.gov>

CVO phone number: 360-993-8973 (Monday to Friday, 8 a.m. to 4:30 p.m.)

## **2. National Oceanic and Atmospheric Administration (NOAA)**

NOAA is responsible for the operational forecasting and monitoring of the state of the atmosphere, including the presence of volcanic ash clouds injected into the atmosphere by eruptions. NOAA, through several of its line offices, maintains the observational, analytical, and forecasting capabilities required to estimate the location and movement of volcanic ash clouds throughout its areas of responsibility.

### **National Weather Service (NWS)**

NOAA's NWS shares the responsibility of operating the Washington D.C. Volcanic Ash Advisory Center (W-VAAC) with NESDIS. The NWS operates:

- The International Civil Aviation Organization (ICAO) -stipulated World Area Forecast Center (WAFC)
- Three Meteorological Watch Offices (MWO) located in Anchorage, Honolulu, and Kansas City.
- Numerous Weather Forecast Offices (WFO).
- Twenty-one Center Weather Service Units (CWSU) in support of FAA ARTCCs.

Through these units, the NWS provides forecasts and warnings for volcanic ash.

### **National Environmental Satellite, Data and Information Service (NESDIS)**

The Satellite Analysis Branch of NESDIS operates the W-VAAC located in Camp Springs, Maryland in conjunction with the NWS, National Centers for Environmental Prediction (NCEP). Information on the W-VAAC is included on pages 13-14.

## **NWS Weather Forecast Offices (WFOs)**

NWS WFOs mission are to provide weather, hydrologic, and climate forecasts and warnings for the protection of life and property and the enhancement of the national economy. WFOs are staffed 24 hours a day, 365 days a year.

WFOs data and products are part of a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community.

WFOs in Washington and Oregon participate in volcanic ash response by issuing volcanic ashfall statements, forecasts, advisories, and warnings to the public, aviation and marine community. Furthermore, WFOs are responsible for public warnings of lahars via the flash flood program. NWS roles and responsibilities for lahars are addressed in the local "ground based" volcano response plans (Appendix D).

WFOs also share observations of eruptions and the resulting volcanic threat with USGS and other agencies as needed.

### **WFO Seattle WA (SEW)**

WFO Seattle's forecast area covers most of Western Washington (and adjacent ocean areas).

Office web site: <http://www.wrh.noaa.gov/sew/>  
Public phone number: 206-526-6087

### **WFO Spokane WA (OTX)**

WFO Spokane's forecast area includes Northeast Washington and Northern Idaho.

Office web site: <http://www.wrh.noaa.gov/otx>  
Public phone number: 509-244-6395

### **WFO Portland OR (PQR)**

WFO Portland's forecast area (and adjacent ocean areas) includes Southwest Washington and Northwest Oregon.

Office web site: <http://www.wrh.noaa.gov/pqr>  
Public phone number: 503-261-9246

**WFO Pendleton OR (PDT)**

WFO Pendleton's forecast area includes Northeast Oregon and Southeast Washington.

Office web site: <http://www.wrh.noaa.gov/pdt>  
Public phone number: 541-276-4493

**WFO Medford OR (MFR)**

WFO Medford's forecast area (and adjacent ocean areas) includes Southwest Oregon and extreme Northern California.

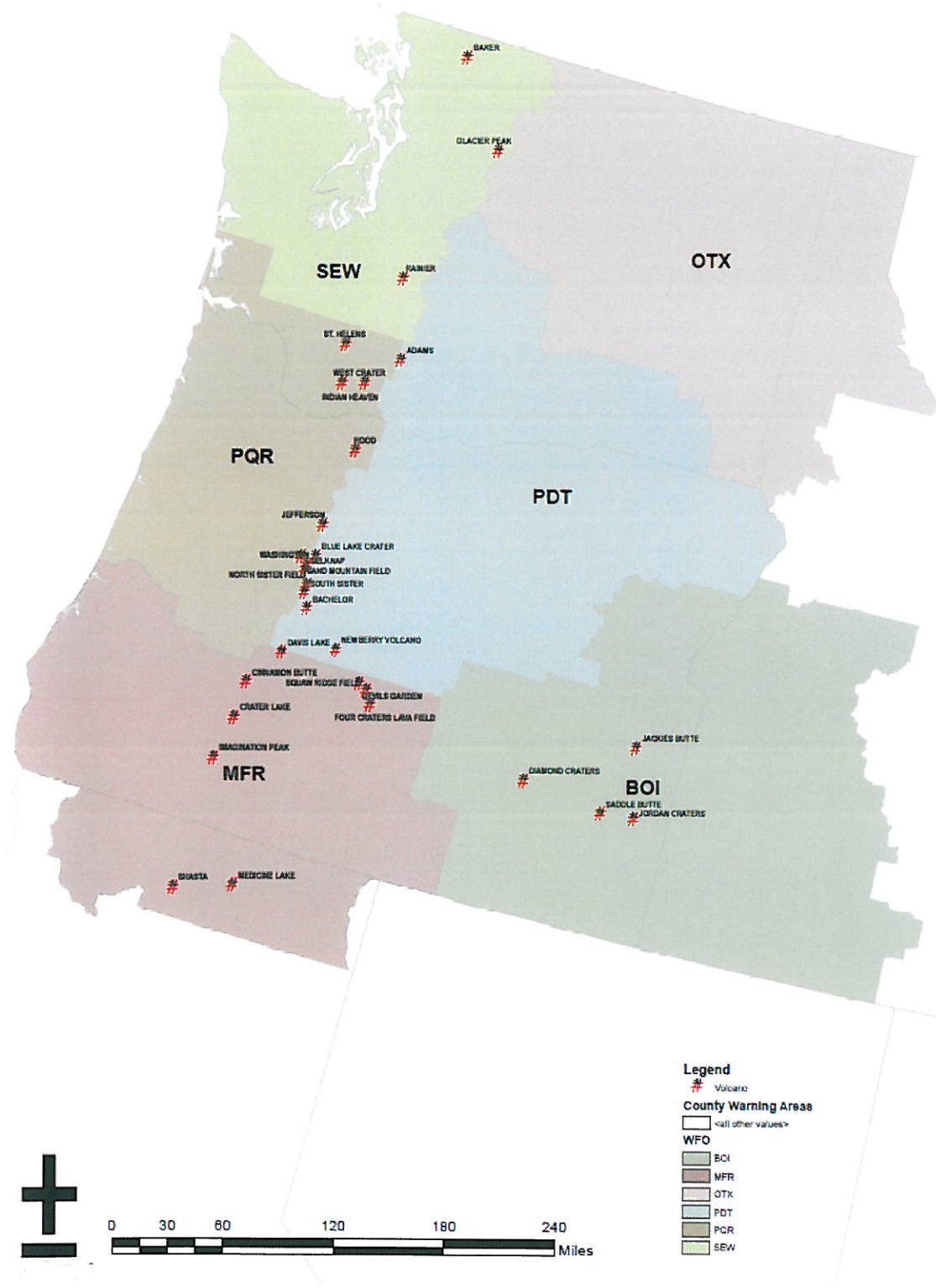
Office web site: <http://www.wrh.noaa.gov/mfr>  
Public phone number: 541-773-1067

**WFO Boise ID (BOI)**

WFO Boise's forecast area includes Southeast Oregon and Southwest Idaho.

Office web site: <http://www.wrh.noaa.gov/boi>  
Public phone number: 208-334-9860

# Pacific Northwest Forecast Offices





## **Center Weather Service Units (CWSU)**

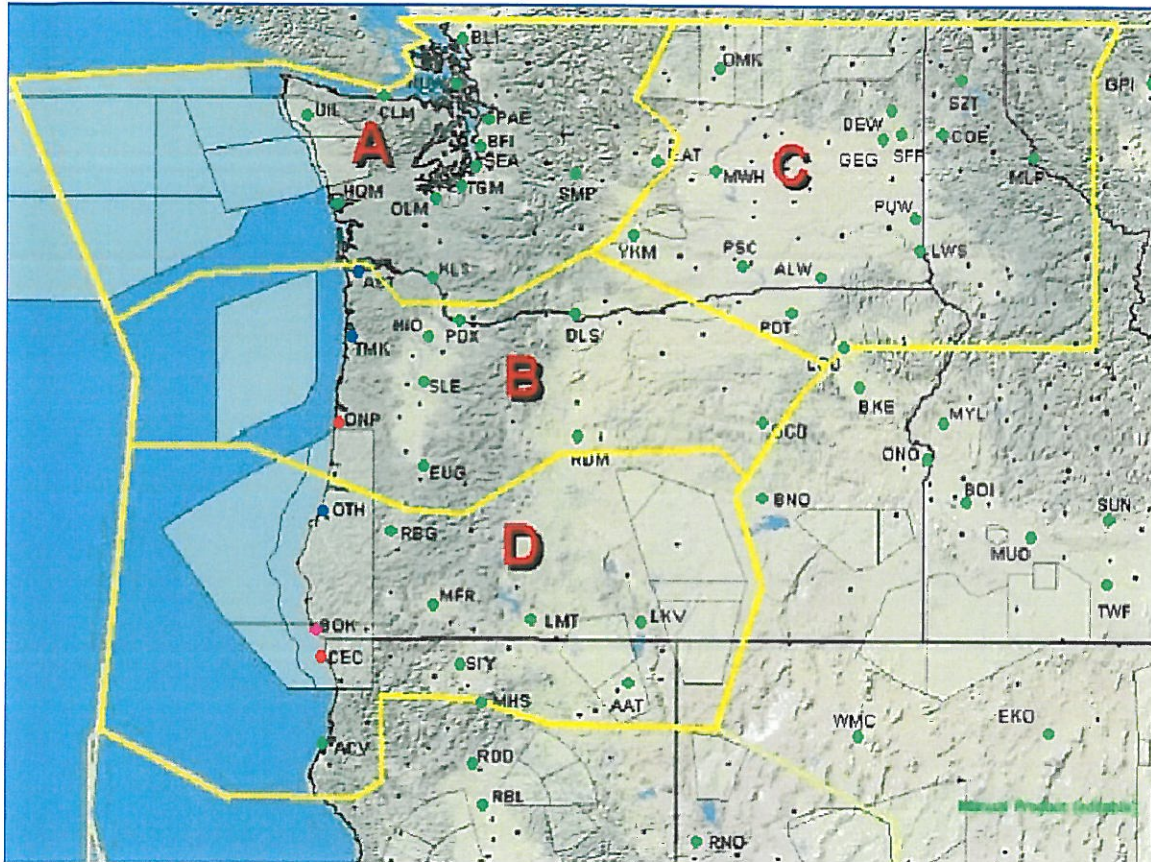
NWS meteorologists in CWSUs are components of the FAA's 21 ARTCCs. NWS personnel work as a team with FAA Air Traffic Control (ATC) specialists. They provide information critical to the safe and efficient flow of air traffic and serve the National Airspace System (NAS) directly. CWSU forecasters provide meteorological consultation, forecasts, and advice to ARTCC managers, staff, and other supported FAA facilities and activities, regarding weather impact on their missions. Rerouting of aircraft around hazardous weather is based largely on forecasts provided by the CWSU meteorologist. The CWSU is also the liaison between FAA facilities and other NWS offices in its area. CWSU meteorologists may assist in the distribution of weather forecasts, advisories, and warnings issued by other NWS offices. Complete details of the relationship between the FAA and the CWSU are contained in an interagency agreement.

Weather support is accomplished through various products and verbal briefings describing weather conditions (forecasts or observations) which may affect air traffic flow or operational safety in the ARTCC's portion of the NAS (the CWSU area of responsibility), and in other locally-defined, special operations areas (e.g., offshore helicopter operations areas). Additionally, the CWSU provides advisories of hazardous weather conditions for airborne aircraft. These advisories are disseminated through NWS and FAA communications systems and are available to both internal FAA and external aviation users. Normal CWSU operations hours in the ARTCC are sixteen hours a day, seven days a week. CWSU meteorologists are available to work outside normal business hours (e.g. overtime) during high impact weather situations such as volcanic ash events.

### **CWSU Seattle (ZSE) Washington**

Located in Auburn, Washington, CWSU Seattle's forecast area covers Washington, Idaho Panhandle, most of Oregon, and extreme Northern California, and adjacent ocean airspace.

Office web site: <http://www.wrh.noaa.gov/zse>



CWSU ZSE's forecast area and sectors

### CWSU Oakland (ZOA) California

Located in Fremont, California, CWSU Oakland's forecast area covers most of Northern California, Central California, most of Northwest Nevada and adjacent ocean airspace. Further, CWSU ZOA provides weather support to the Oceanic routes in the area of the East-North Pacific Ocean.

Office web site: <http://www.wrh.noaa.gov/zoa>





### **ZOA's Oceanic Flight Information Region (FIR)**

#### **Aviation Weather Center (AWC)**

Located in Kansas City, MO, the AWC serves as the ICAO Meteorological Watch Office (MWO) for the CONUS and surrounding waters. AWC's mission is to deliver consistent, timely and accurate weather information for the world airspace system and to enhance safe and efficient flight. AWC is staffed 24 hours a day, 365 days a year.

Office web site: <http://aviationweather.gov>

#### **Washington Volcanic Ash Advisory Center (W-VAAC)**

The W-VAAC is a collaborative effort between the Office of Satellite Data Processing and Distribution, Satellite Analysis Branch (SAB), of NESDIS and NCEP Central Operations of the National Weather Service (NWS). The NESDIS portion of the VAAC uses a variety of satellite imagery and techniques to confirm the presence of volcanic ash clouds and track their movement during and following eruptions. The VAAC issues Volcanic Ash Advisories (VAA) that provide current locations and forecasted movements/locations of an ash cloud. A VAA is accompanied by a graphical depiction (Volcanic Ash Graphic - VAG) of an ash

cloud if such is detectable in satellite imagery. The NCEP portion of the W-VAAC is co-located with the W-VAAC in Camp Springs, Maryland, and runs and issues the HYSPLIT Volcanic Ash Forecast Transport and Dispersion (VAFTAD) model to provide forecast guidance of the dispersion of volcanic ash clouds. The W-VAAC is staffed 24 hours a day, 365 days a year.

Office web site: <http://www.ssd.noaa.gov/VAAC/washington.html>

### **3. Federal Aviation Administration (FAA)**

The FAA is responsible for issuing and disseminating Notices to Airmen (NOTAM) when notified of precursory volcanic unrest, eruptive activity, or volcanic ash in the NAS. In addition, the FAA, through its communication network, disseminates information on volcanic ash to Airline Operations Centers (AOC) and other operators using the NAS, as well as the agency's affected Air Traffic Management elements, including its, ARTCCs, Terminal Radar Approach Control (TRACON) facilities, Flight Service Stations (FSS), Airport Traffic Control Towers (ATCT), and the ATCSCC.

The FAA defines an ARTCC as a facility established to provide air traffic control service to aircraft operating on Instrument Flight Rules (IFR) flight plans within controlled airspace, principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to Visual Flight Rules (VFR) aircraft. Air traffic controllers working within an ARTCC communicate via radio with pilots on instrument flight rules aircraft passing through the ARTCCs airspace. ARTCCs are electronically linked through the NAS, which allows nationwide coordination of traffic flow to manage congestion. Controllers monitor the progress of flights and instruct aircraft to perform course adjustments as needed to maintain separation from other aircraft. Pilots may request altitude adjustments or course changes for reasons including avoidance of turbulence or volcanic ash. ARTCCs are staffed 24 hours a day, 365 days a year.

#### **Air Route Traffic Control Center – Seattle WA**

Located in Auburn, Washington, Seattle ARTCC's airspace encompasses approximately 300,000 square miles including all of Washington, most of Oregon and portions of Montana, Idaho, Nevada and California. The center boundaries extend from the Canadian border to Northern California and from western Montana to 150 miles off the Pacific Coast. There are nine approach controls in Seattle Center's airspace.

Seattle ARTCC public phone number: 253-351-3520

### **Air Route Traffic Control Center – Oakland California**

Located in Fremont, California, the ARTCC is the owner of the largest airspace in one facility in the world, 9.7% of the world's surface. The airspace is composed of 140,000 square miles domestically, and 18.7 million square miles Oceanic. Oakland ARTCC domestic controllers interface and dialog with many domestic ARTCCs, approach controls, and towers on a routine basis. Oakland Oceanic Controllers interface with 19 different foreign and domestic facilities.

Oakland ARTCC public phone number: (510) 745-3331

### **Northwest Mountain Regional Office**

The FAA Northwest Mountain Regional Office located in Renton, Washington manages FAA facilities in Colorado, Idaho, Montana, Oregon, Utah, Washington and Wyoming. The administrator's office is open Monday-Friday during normal business hours.

Office Web Site:

[http://www.faa.gov/about/office\\_org/headquarters\\_offices/arc/ro\\_center/index.cfm?file\\_name=contact\\_us\\_northwest\\_mountain](http://www.faa.gov/about/office_org/headquarters_offices/arc/ro_center/index.cfm?file_name=contact_us_northwest_mountain)

Public phone number: 425-227-2001

Regional Operations Center public phone number: 425-227-2000  
(24 hour accident and incident response)

### **Air Traffic Control System Command Center (ATCSCC)**

Located in Warrenton, Virginia the ATCSCC balances air traffic demand with system capacity in the NAS. The Command Center, as it is commonly known, is committed to managing the NAS in a safe, efficient, and cohesive manner. The ATCSCC is staffed 24 hours a day, 365 days a year.

Public phone number: 1-866-tellfaa

[www.fly.faa.gov/flyfaa/usmap.jsp](http://www.fly.faa.gov/flyfaa/usmap.jsp)



### **III. Products and Procedures of Partnering Agencies**

#### **1. USGS**

##### **CVO Responsibilities**

###### **a. Products**

**Call Downs:** As a volcano moves from quiescent to active, CVO will note the uptick (and eventually downtick) in activity through telephone call-down procedures and through written notices. Call-downs occur when a) there is a change in the alert level and/or, aviation color code; b) to inform about the start or end of eruptive activity and c) to update information regarding the eruption, such as eruption style, plume height (if any), intensity duration or other parameters as they are known. See Appendix E for an example of a call down list for Mount St Helens.

**Volcanic Activity Notice (VAN):** Upon a change of an alert level or recognition of the beginning or cessation of volcanic activity, the observatory will issue a VAN after a telephone call-down procedure is completed. The VAN consists of a formatted text message describing current activity at the volcano and forecasts likely outcomes. The VAN goes out via email and FAX to Federal, State, local and tribal governmental agencies and the media. The message is also immediately posted on the CVO website and updated on the Volcano Hazards Program (VHP) website. Additional VANs are released as needed depending on changes in volcanic activity, alert level or hazards.

**Volcano Observatory Notice for Aviation (VONA):** A VONA is a derivative product of the VAN and contains information in a format specifically intended for aviation users of volcano hazard information. A VONA is produced automatically and sent via e-mail and FAX to aviation agencies and aviation industry users who have requested such information.

**Daily Status Report or Update:** CVO issues a Daily Update for any Cascade volcano at an elevated alert level or aviation color code. The daily reports are sent via emails and FAX to all agencies and groups that receive VANs and are posted on the CVO website.

**Weekly Updates and Information Statements:** CVO issues a weekly summary of volcanic activity in the Cascades each Friday. These reports are posted to the CVO website and are sent via FAX and emails to all agencies and groups that receive VANs. CVO may also issue a non-

scheduled Information Statement that highlights events at or near a volcano that may or may not be related to volcanic activity, but might be noted by the public. For example, a minor seismic swarm at a volcano or a non-volcanic event like a debris flow that is the result of a meteorological event might warrant an Information Statement.

Recorded telephone messages: During times of volcanic activity that causes intense public or media interest, CVO will post a message on their front desk phone as to where individuals can obtain more information about the current activity.

24x7 answering service: CVO maintains a 24x7 answering service through their operations number, which is available to agency personnel. The answering service has a list of about 10 senior scientists who can answer agency questions about volcanic activity (either ongoing or perceived). The agency must continue calling through the list until they reach a person; they are not allowed to leave a message. On weekends, the duty scientist checks for public calls on the front desk phones.

**b. Services**

CVO provides up-to-date information on volcanic activity in the Washington and Oregon Cascades and the basaltic lava fields south-central Washington, eastern Oregon and south-central Idaho. Information about any suspected or known volcanic activity will be distributed through call-downs, VANs and VONAs, Information Statements, and Status Reports. All written information will also be posted to the web.

**c. Collaboration:**

CVO coordinates messages regarding alert-level changes with monitoring partners, the land managers of the volcanoes and the appropriate State emergency management office, who has responsibility to broadcast warnings to local and tribal agencies. CVO collaborates with the NWS on messages and information regarding volcanic ash fall and lahars (see ground based plans; Appendix D) and gives information to NWS and FAA on eruption plume heights, potential mass eruptive rates and eruptive activity start and end times.

**d. Cascade volcanoes of responsibility:**

1. Mount Baker
2. Glacier Peak

3. Mount Rainier
4. Mount St. Helens
5. Mount Adams and surrounding basaltic fields
6. Mount Hood
7. Mount Jefferson
8. Three Sisters and surrounding basaltic volcanic fields
9. Newberry Volcano
10. Crater Lake

**e. CVO Procedures:**

CVO procedures will vary depending on whether a volcano is in its normal background state, is showing signs of increasing volcanic activity that may lead to an eruption, is in eruption, or is showing diminished signs of eruptive activity. Below are standard CVO procedures for different levels of unrest and eruption.

**Aviation Color Codes**

<b>GREEN:</b>	Volcano is in typical background, noneruptive state or, <i>after a change from a higher level</i> , volcanic activity has ceased and volcano has returned to noneruptive background state.
<b>YELLOW:</b>	Volcano is exhibiting signs of elevated unrest above known background level or, <i>after a change from a higher level</i> , volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
<b>ORANGE:</b>	Volcano is exhibiting heightened or escalating unrest with increased potential of eruption, timeframe uncertain, <b>OR</b> eruption is underway with no or minor volcanic-ash emissions [ash-plume height specified, if possible].
<b>RED:</b>	Eruption is imminent with significant emission of volcanic ash into the atmosphere likely <b>OR</b> eruption is underway or suspected with significant emission of volcanic ash into the atmosphere [ash-plume height specified, if possible].

1. Aviation Color Code GREEN: Typical CVO operations—normal office hours (8:30 a.m. to 5 p.m.), weekly updates, duty scientist checking on volcanoes during evenings and weekends.
2. Aviation Color Code YELLOW: When changing to YELLOW, telephone call down to correct FAA ARTCC group; NWS WFO; W-VAAC; FAA HQ and AFWA. Depending on interest of media and uncertainty of

situation (during escalating unrest), CVO may extend hours of operations with additional overnight checks or move to 24x7 operations, and may establish a Joint Information Center (JIC) with emergency and land management agencies to answer questions regarding the activity and potential hazards and give short-term forecasts. Also during escalating unrest, Federal land owners request a Temporary Flight Restriction (TFR) around the volcano from FAA.

3. Aviation Color Code ORANGE: When changing to ORANGE, a telephone call down to correct FAA ARTCC group; NWS WFO; WA-VAAC; FAA HQ and AFWA. Issue written statements as needed. During escalating unrest, depending on interest of media and uncertainty of situation, CVO may extend hours of operations with overnight checks or 24x7 operations. Discussions with WFO on messaging regarding potential ash fall. CVO will work with the JIC (if established) to answer questions regarding the activity and potential hazards and give short-term forecasts. Federal land managers may make a request for a TFR from the FAA.
4. Aviation Color Code RED: If CVO feels that an eruption is imminent, it may initiate a telephone call down for change of alert level. Once an eruption begins, it will begin a telephone down to the correct ARTCC group, NWS WFO, W-VAAC, FAA HQ and AFWA and continue updating information on call down every 20-30 minutes as the situation warrants until activity at the volcano ceases. Send out VANs and VONAs and written updates as warranted. CVO will be in a 24x7 operational mode. Discuss ash messaging with WFO. CVO will work with the JIC to answer questions regarding the activity and potential hazards and give short-term forecasts. Federal land managers may request for a TFR from FAA.

## 2. NOAA/NWS

### Pacific Northwest WFOs

#### a. Products:

**Public and Marine Ashfall Advisories and Warnings:** Public and/or Marine ashfall advisories and warnings are products designed to alert the public when ashfall is expected in the WFO area of responsibility. These products contain the spatial extent and progress of the ash as coordinated with other NWS offices and the CVO.

**Terminal Aerodrome Forecast (TAF):** TAFs are used by a variety of aviation users, including domestic and international commercial airlines, general aviation (GA), civilian, and military operators. TAFs

are prepared, issued, and distributed on a timely basis to meet FAA and ICAO requirements, and using a code format designed by the World Meteorological Organization (WMO) for both domestic and international use.

TAFs will include volcanic ash when ash is present or expected at ground level or any level over the terminal area (5 mi radius from center of runway). TAFs will be updated immediately if volcanic ash is present or expected.

**b. Services:**

WFOs provide support for all the parties in this operating plan by soliciting spotter and/or pilot reports, monitoring radar and satellite observations, and forwarding all pertinent information to CVO, AWC, W-VAAC and appropriate CWSU. The WFO also responds to public inquiries during a volcanic eruption, solicits damage reports and disseminates local storm reports (LSR) with specific volcanic ashfall information.

**c. Collaboration:**

The WFO will coordinate with the CVO Duty Scientist after receiving reports of an eruption. The CVO will confirm or repudiate activity. The WFO will ensure AWC, CWSU, and W-VAAC are aware of any eruptive activity. Lastly, the WFO will call the NCEP Senior Duty Meteorologist for a HYSPLIT run for volcanic ash transport and dispersion.

**d. Volcano and Responsible WFO (listed geographically from north to south):**

- Mt Baker: WFO Seattle
- Glacier Peak: WFO Seattle
- Mt Rainier: WFO Seattle
- Mt Adams: WFO Pendleton
- Mt St Helens: WFO Portland
- Mt Hood: WFO Portland
- Mt Jefferson: WFO Pendleton
- Three Sisters: WFO Pendleton
- Newberry Crater: WFO Pendleton
- Crater Lake: WFO Medford



**e. WFO Procedures:**

- i. Aviation Color Code GREEN: Typical WFO operations. Situation normal.
- ii. Aviation Color Code YELLOW: During an increasing alert level, planning discussions begin with CVO and NWS offices. Plans and procedures will be reviewed. The NWS Western Region Operations Center (ROC) will schedule and facilitate a planning conference call with CVO, appropriate NWS offices and FAA.
- iii. Aviation Color Code ORANGE: During an increasing alert level, contingency plans in place for extra staffing and products are prepared for rapid dissemination. If eruption is underway with no or minor ash, special weather statements will be coordinated with CVO.
- iv. Aviation Color Code RED:
  - 1. If eruption is imminent and not yet underway, special weather statements will be coordinated with CVO.
  - 2. Once notified of an eruption that will produce ashfall:
    - a. WFO will collaborate with the CVO and W-VAAC.
    - b. Call the NCEP Senior Duty Meteorologist for a HYSPLIT run for volcanic ash transport and dispersion.
    - c. A collaboration call will be made to the CWSU, surrounding WFOs and AWC to share information.
    - d. Issue appropriate product(s) for the threat.
    - e. Notify any air traffic control towers in the vicinity of volcano or ash.
    - f. Notify the NWS Western Region ROC of eruption, and the ROC will facilitate any conference calls.
    - g. Answer public and media questions regarding the ashfall trajectory and wind forecasts, and refer all questions on the geological aspects of the eruption to the CVO. CVO and WFO will coordinate on talking points for ashfall.
    - h. Follow up collaboration calls will be conducted with appropriate offices as needed.

## CWSU Responsibilities

### a. Products:

**Urgent Pilot Report (UUA):** An UUA Pilot Report (PIREP) is disseminated by the CWSU immediately upon notification from an air traffic controller of a volcanic eruption. Weather Coordinators at the ARTCC may also issue UUAs especially during times the CWSU staff is not on duty.

**Center Weather Advisory (CWA):** The CWA contains information about eruptions and location of volcanic ash for a 0-2 hour period. The CWA is an in-flight aviation weather warning for pilots, air traffic controllers, and ARTCC operational staff. The CWA should be issued for volcanic activity that is below Significant Meteorological Information (SIGMET) criteria but still merits attention by aviation operations.

**Meteorological Impact Statement (MIS):** The MIS is an information product for eruptions and the location of volcanic ash that are less significant and is issued for a 2-48 hour period. The MIS is an “in-flight” aviation weather statement for Air Traffic Managers.

### b. Services:

The CWSU’s primary mission is to support Air Traffic Management decisions. The CWSU provides on-demand briefings during volcanic ash eruptions and distributes AWC warning products (i.e. SIGMET), and CWSU products to the appropriate Air Traffic Manager, controllers and/or facilities (i.e. TRACON and ATCT). If the CWSU is closed for the night, the AWC will assume primary CWSU responsibility as the backup office for traffic management support.

### c. Collaboration:

The CWSU will coordinate with the appropriate WFO and AWC after receiving reports of an eruption and relay any PIREPs as appropriate. The CWSU will ensure surrounding CWSUs are aware of the eruption.

### d. Volcano and Responsible CWSU:

- CWSU Seattle
  - a. Mt Baker
  - b. Glacier Peak

- c. Mt Rainer
- d. Mt Adams
- e. Mt St Helens
- f. Mt Hood
- g. Mt Jefferson
- h. Three Sisters
- i. Newberry Crater
- j. Crater Lake

**e. CWSU Procedures:**

- a. Aviation Color Code GREEN: Typical CWSU operations. Situation normal.
- b. Aviation Color Code YELLOW: During an increase in alert level, planning discussions begin with CVO, FAA and NWS management. Plans and procedures reviewed.
- c. Aviation Color Code ORANGE: During an increase in alert level, contingency plans in place for overtime and products are prepared for rapid dissemination. If eruption is underway with no or minor ash, MIS will be coordinated with WFO and AWC.
- d. Aviation Color Code RED:
  - i. If eruption is imminent and not yet underway, MIS will be coordinated with WFO and AWC.
  - ii. Once notified of a volcanic eruption or volcanic ash:
    - 1. Notify the Traffic Management Unit in the ARTCC and verify an urgent PIREP has been disseminated.
    - 2. Call AWC and WFO to collaborate on ash height, trajectory and NWS products.
    - 3. Collaborate with all surrounding CWSUs.
    - 4. Answer any FAA questions regarding the ash trajectory and wind forecasts, and refer all questions on the geological aspects of the eruption to the CVO.
    - 5. Follow up collaboration calls will be conducted with appropriate offices as needed.

**MWO/AWC Basic Responsibilities**

The ICAO Annex 3 to the Convention on International Civil Aviation, "Meteorological Service for International Air Navigation" (ICAO, 2010) describes products provided by WAFCs, MWOs, and VAACs. These products are described below.

**a. Products:**

**SIGMETs for Volcanic Ash Cloud:** A SIGMET for volcanic ash clouds will be issued for volcanic eruptions. The SIGMET enhances tactical decision-making for en-route air traffic. The SIGMET represents a snapshot of the observed ash cloud position and includes a six-hour forecast position. VA SIGMETs are issued for all volcanic eruptions or remote ash clouds (primary and re-suspended) within the AWC area of responsibility, regardless of the eruption's magnitude or the size of the ash cloud. VA SIGMETs are re-issued and updated until the ash cloud is no longer a threat to aviation.

When a MWO receives information that a volcanic eruption has occurred, a VA SIGMET is issued immediately. If the notification came from a VAAC, the SIGMET is based on forecast information from a VAA. If the notification came from a source other than a VAAC, then an initial VA SIGMET is issued based on satellite observations, METARs, and/or credible pilot reports. The SIGMET is updated as soon as a VAA statement becomes available.

Also, AWC will amend Area Forecasts (FA) to include forecasts of surface visibility restrictions caused by volcanic ash. The forecast of visibility restriction for the FA is based the forecast positions through 18 hours from the VAAC, and on METARs and/or credible pilot reports. The FA supports general aviation flight planning operations.

Finally, AWC will include the active volcano in the World Area Forecast System (WAFS) global forecasts. The active volcano will be added to the forecasts until notified by the VAAC that activity has ceased. This information aids in flight planning efficiency of medium and long-haul flights by notifying flight dispatchers and flight crews that volcanic activity is possible near the volcano.

**b. Services:**

AWC provides weather information to the world airspace system for safety and efficiency of flight. AWC volcanic ash SIGMETs and FAs will be disseminated via the NWS telecommunication gateway into FAA and world airspace systems. In addition, AWC's products can be found on AWC's web site:

[http://aviationweather.gov/adds/phputils/wrap\\_image.php](http://aviationweather.gov/adds/phputils/wrap_image.php)

c. **Collaboration:**

AWC will coordinate with the appropriate VAAC, CWSU, and FAA after receiving reports of an eruption. AWC will ensure surrounding MWOs are aware of the eruption.

d. **Procedures:**

- i. Aviation Color Code GREEN: Typical AWC operations. Situation normal.
- ii. Aviation Color Code YELLOW: During an increase in alert level, planning discussions begin with USGS, W-VAAC and NWS management. Plans and procedures reviewed.
- iii. Aviation Color Code ORANGE: During an increase in alert level, contingency plans in place for extra staffing. If eruption is underway with no ash, any statements will be handled by the WFO and CWSU.
- iv. Aviation Color Code RED:
  1. If eruption is imminent and not yet underway, any statements will be handled by the WFO and CWSU.
  2. Once notified of a volcanic eruption or volcanic ash:
    - a. Issue SIGMET
    - b. Contact W-VAAC
    - c. Re-issue SIGMET with VAAC information
    - d. Update FA to include any visibility restriction at the surface
    - e. Include active volcano on WAFS forecasts
    - f. Follow up collaboration calls will be conducted with:
      - i. Adjacent MWO
      - ii. CWSU(s)
      - iii. WFO
      - iv. CVO
      - v. WAFC London

**Washington VAAC Basic Responsibilities**

i. **Products**

**Volcanic Ash Advisory (VAA):** Information issued by the W-VAAC concerning the occurrence or expected occurrence of airborne volcanic ash, because ash may affect the safety of aircraft operations. A VAA is a text message that identifies the volcano, time of eruption, observed position of the ash cloud, and the forecasted position of the

ash. The VAA is distributed through several global networks, and is placed on the internet. The VAA is not to be used as a warning message. The VAG is a graphical depiction of the VAA.

The HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory) model is configured to run volcanic ash simulations operationally at NOAA NCEP in support of the W-VAAC. Graphical model output is displayed in "Volcanic Ash Forecast Transport and Dispersion (VAFTAD)" format and is distributed over the World Area Forecast System (WAFS) and placed on the internet (<http://aviationweather.gov.ifddp.volc.php/>). The graphical output depicts areas of "visual ash". The model visual ash boundary is based on a correlation between historical model output and satellite analysis, and further refined when the VAAC chooses, as the visual ash boundary, a model concentration contour that best depicts the forecast based on the observed ash area and/or other information. High temporal resolution HYSPLIT output is available internally to the NWS and SAB, and is planned to be made externally available.

#### **ii. Services:**

The W-VAAC monitors volcanic activity through satellite remote sensing and is responsible for the initial notification to NOAA of a volcanic event. Imagery from satellites allows the VAAC to detect the boundaries of a volcanic ash cloud and to estimate the altitude and movement of the ash plume. This information is included in the VAA and VAG.

The SDM of the W-VAAC is responsible for running the HYSPLIT model to forecast ash transport and dispersion. The NCEP SDM may also declare a Critical Weather Day after a volcanic eruption. Critical Weather Days will ensure that the computer, communications, and personnel resources of the NCEP are directed toward production and delivery of essential forecast products. This policy will minimize the chance of delay in the delivery of NCEP products and services.

#### **iii. Collaboration:**

The W-VAAC will collaborate with CVO on volcanic ash detection and notify by phone the weather service offices responsible for issuing official watches and warnings. The W-VAAC and the MWO



collaborate to determine the visual ash boundary for the graphical product.

**iv. Procedures:**

- i. Aviation Color Code GREEN: Typical VAAC operations and monitoring.
- ii. Aviation Color Code YELLOW: During an increase in alert level, planning discussions begin with AWC and NWS management.
- iii. Aviation Color Code ORANGE: During an increase in alert level, contingency plans in place for extra staffing. If eruption is underway with no or minor ash, any statements will be handled by the WFO and CWSU.
- iv. Aviation Color Code RED:
  - 1. If eruption is imminent and not yet underway, any statements will be handled by the WFO and CWSU.
  - 2. Upon detection of volcanic ash in satellite imagery or upon receipt of report of volcanic ash from a reliable source, W-VAAC will call via commercial phone lines:
    - i. AWC
    - ii. Air Force Weather Agency
    - iii. Cascades Volcano Observatory

W-VAAC shall take these additional actions:

- a. Issue a VAA if appropriate
- b. Run the HYSPLIT VAFTAD model if appropriate.
- c. Gather/determine additional information about an ash cloud and issue a complete VAA and VAG.
- d. Continue to monitor and issue updates at least every 6 hours or for any major changes in height or movement.
- e. Coordinate with CVO and AWC to determine the end of the event and issue final messages.
- f. Coordinate with the Montreal VAAC if ash is likely to enter into their region.
- g. Post and archive VAA and accompanying VAG if any, on the website of the Satellite Services Division of NESDIS.

For information on all NWS service backup operations refer to NWS Instruction 10-2201 –

<http://www.nws.noaa.gov/directives/sym/pd01022001curr.pdf>

### **3. FAA**

#### **Seattle ARTCC Responsibilities**

##### **a. Products and Services**

When the CVO upgrades the aviation color code to ORANGE or RED, the Operations Manager in Charge (OMIC), Front Line Manager (FLM) and/or Traffic Management Unit (TMU) will issue a volcanic ash advisory NOTAM which will include the color code.

Upon receiving notification of an eruption or imminent eruption (aviation color code RED), the OMIC, FLM and/or TMU will take the following actions:

Notify the CWSU meteorologist. If an eruption occurs when the CWSU meteorologist is not on duty, the OMIC will contact the AWC to request a SIGMET be issued. If required, they will contact the CWSU manager to request a meteorologist report immediately to the ARTCC.

The TMU Weather Coordinator will transmit the UUA PIREP.

Issue the NOTAM if it is determined that the volcanic event could endanger airborne aircraft.

Ensure the MIS or CWA is disseminated by the CWSU, if appropriate.

Alert Air Traffic Security Coordinators (ATSC) via the Domestic Events Network (DEN).

Air traffic controllers will ensure that all aircraft in the affected area are aware of the most current information available concerning the volcanic eruption and any resultant ash dispersal. They will, with pilot concurrence, suggest headings or reroutes around known ash or possible ash cloud locations, solicit PIREPs and forward to the FLM, and broadcast information received relating to the volcanic event/ash trajectory.



## **b. Coordination**

The OMIC and/or TMU will notify the following personnel and facilities:

- CWSU Seattle
- Seattle ARTCC FLM
- Seattle ARTCC Traffic Management Officer
- FAA Regional Operations Center
- Service Operations Center (SOC)
- ATCSCC
- ATSC via the DEN

The Seattle ARTCC TMU will review areas affected by volcanic activity to determine if any Traffic Management Initiatives (TMI) are required. The TMU will coordinate and monitor TMIs with affected facilities and the ATCSCC.

## **Oakland ARTCC Ocean Route Responsibilities**

### **a. Products and Services**

Oakland Oceanic is a non-radar control facility, and is mainly in charge of aircraft flying routes leading from the western United States over the Pacific Ocean to many possible destinations, and vice versa. The most commonly found flights which transit Oakland Oceanic airspace go to or arrive from Hawaii, New Zealand, Australia, Japan and China. Aircraft within Oakland Oceanic airspace are separated by non radar methods.

The Oakland Ocean Routes Air traffic controllers will normally receive notification of volcanic ash from the Oakland CWSU, the Oakland ARTCC FLM if the CWSU meteorologist is not on duty, or adjacent ARTCCs in Alaska or Seattle. Upon receiving notification of an eruption or volcanic ash plume entering the airspace, the Oakland Oceanic will verify the following actions:

- Confirm a NOTAM has been issued if it is determined that the volcanic event could endanger airborne aircraft.

- Ensure the MIS, CWA and/or SIGMET is disseminated, as appropriate.

- Alert ATSC via the DEN.

Air Traffic controllers will ensure that all aircraft in the affected area are aware of the most current information available concerning the volcanic eruption and any resultant ash dispersal. They will, with pilot concurrence, suggest headings or reroutes around known ash or possible ash cloud locations, solicit PIREPs and forward to the FLM, and broadcast information received relating to the volcanic event/ash trajectory.

### **Northwest Mountain Regional Office Responsibilities**

The FAA Northwest Mountain Region Office is the administrative focal point for FAA emergency readiness (command, control and communication) in Washington and Oregon. The regional office relies on information provided by CVO, NOAA and other FAA offices for current and forecast conditions. The Regional Operations Center (ROC) located here, is responsible for 24/7 accident and incident response.

### **ATCSCC Responsibilities**

#### **a. Products**

**Advisory Database:** Real-time advisory information as received from FAA facilities. The advisories database system is a web-based application that displays up to the minute U.S. and Canadian advisories ([http://www.fly.faa.gov/adv/adv\\_spt.jsp](http://www.fly.faa.gov/adv/adv_spt.jsp))

**Airport Arrival Demand Chart:** Real-time airport arrival demand information as received from FAA facilities. The chart displays the latest arrival demand metrics for selected airports.

**Current Reroutes:** Displays all current (active) reroutes, with a link to the associated advisory.

**Current Restrictions:** Displays all current restrictions for various facilities.

**Operational Information System (OIS):** Real-time airport delay information as received from FAA facilities. The OIS system is a web-based application that displays up to the minute Ground Delay, Ground Stop, Deicing, and general airport delay information.

#### **b. Services**

The ATCSCC Traffic Management Specialists plan and regulate the flow of air traffic to minimize delays and congestions while maximizing the overall operation of the NAS. Every day, the NAS services tens of thousands of commercial, military, and general aviation aircraft safely across the country.

When significant events impact an airport or portion of airspace, the Traffic Management Specialists adjust traffic demands to meet system capacity. Significant events include:

Adverse Weather (including volcanic ash)  
Equipment Outages  
Runway Closures  
National Emergencies

NOAA/NWS staffs a meteorologist liaison position at the ATCSCC for weather consultation.

#### **IV. Plan Management**

This is the first edition of the Pacific Northwest Interagency Plan for Volcanic Ash Events. This plan should be updated every 5 years. The plan will be maintained by the NOAA/NWS Volcanic Ash program manager or other plan participant as needed. This plan will be on file at Western and Alaska Region Headquarters of the NWS. Table top exercises will be conducted between the agencies involved in the plan as part of the plan update cycle.

#### **V. After Action Reviews (Service Assessments)**

An after action review is a structured review process for analyzing the response to an event, and how the response can be handled better. After action reviews will be conducted for all volcanic ash table top exercises related to this plan, and any real (actual) volcanic ash events impacting the Pacific Northwest.

#### **VI. List of Acronyms**

AFWA	Air Force Weather Agency
AOC	Airline Operations Centers
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control

ATCSCC	Air Traffic Control System Command Center
ATCT	Air Traffic Control Tower
ATSC	Air Traffic Security Coordinator
AWC	Aviation Weather Center
BOI	WFO Boise
CVO	Cascades Volcano Observatory
CWA	Center Weather Advisory
CWSU	Center Weather Service Unit
DEN	Domestic Events Network
DOD	Department of Defense
FA	Area Forecast
FAA	Federal Aviation Administration
FIR	Flight Information Region
FLM	Front Line Manager
FSS	Flight Service Station
GA	General Aviation
HYSPLIT	HYbrid Single-Particle Lagrangian Integrated Trajectory
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
JIC	Joint Information Center
LSR	Local Storm Report
MCC	Maintenance Control Center
MIS	Meteorological Impact Statement
MFR	WFO Medford
MWO	Meteorological Watch Office
NAS	National Airspace System
NCEP	National Center for Environmental Prediction
NCSN	Northern California Seismic Network
NESDIS	National Environmental Satellite Data Information Service
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NWS	National Weather Service
OIS	Operational Information System
OMIC	Operations Manager in Charge
OR	Oregon
OTX	WFO Spokane
PDT	WFO Pendleton
PIREP	Pilot Weather Report
PNSN	Pacific Northwest Seismic Network
PQR	WFO Portland
ROC	Regional Operations Center
SAB	Satellite Analysis Branch
SDM	Senior Duty Meteorologist
SEW	WFO Seattle

SIGMET	SIGnificant METeorological Information
SOC	Service Operations Center
TAF	Terminal Aerodrome Forecast
TMI	Traffic Management Initiative
TMU	Traffic Management Unit
TRACON	Terminal Radar Approach Control
TFR	Temporary Flight Restriction
USGS	United States Geological Survey
UUA	Urgent Pilot Report
VA	Volcanic Ash
VAAC	Volcanic Ash Advisory Center
VAA	Volcanic Ash Advisory
VAFTAD	Volcanic Ash Forecast Transport and Dispersion
VAG	Volcanic Ash Graphic
VAN	Volcanic Activity Notice
VFR	Visual Flight Rules
VHP	Volcano Hazards Program
VONA	Volcano Observatory Notice for Aviation
WA	Washington
WAFC	World Area Forecast Center
WAFS	World Area Forecast System
WFO	Weather Forecast Office
WMO	World Meteorological Organization
W-VAAC	Washington Volcanic Ash Advisory Center
ZOA	Oakland ARTCC
ZSE	Seattle ARTCC

**VII. Principle Contacts Phone Numbers – NOT FOR PUBLIC DISTRIBUTION**

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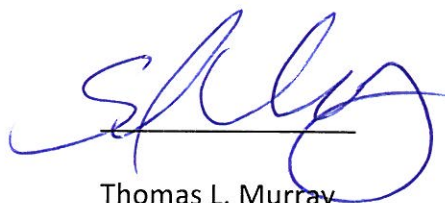
VIII. Signature Page

5/20/11  
Date



Vickie L. Nadolski  
Director, NWS Western Region

5-25-11  
Date



Thomas L. Murray  
Director, USGS Volcano Science Center

5-26-11  
Date



Chris S. Metts  
Director, En Route & Oceanic Western  
Operations



# Appendices

## Appendix A

List of Volcanoes in Washington and Oregon (listed from north to south)

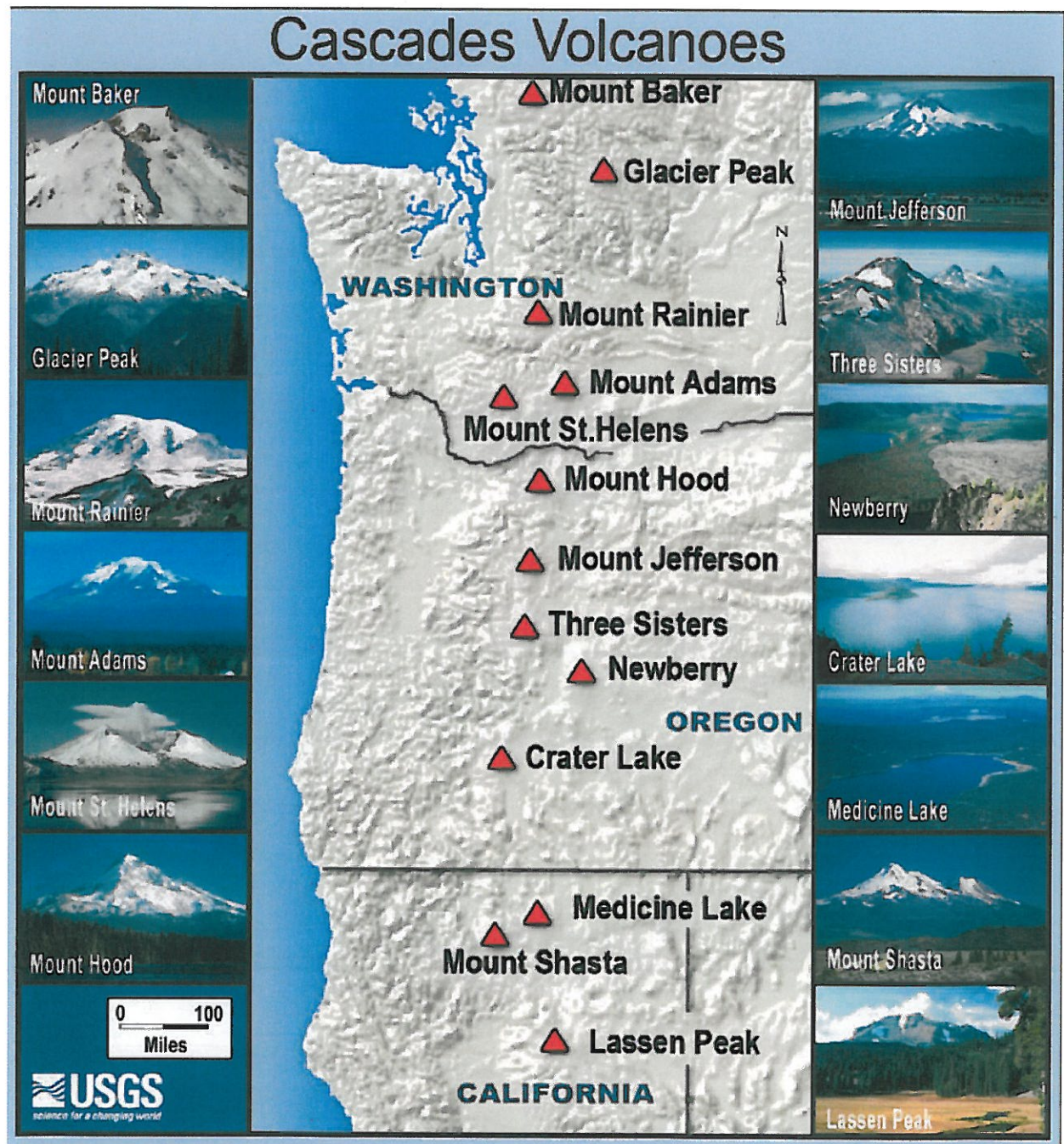
### Washington

Mount Baker  
Glacier Peak  
Mount Rainier  
Mount Adams  
Mount St. Helens

### Oregon

Mount Hood  
Mount Jefferson  
Three Sisters  
Newberry  
Crater Lake

Appendix B  
Map of Cascades Volcanoes



## Appendix C

**Office of the Federal Coordinator for Meteorological Services and Supporting  
Research, National Volcanic Ash Operations Plan for Aviation**

<http://www.ofcm.gov/p35-nvaopa/fcm-p35.htm>

## Appendix D

### Ground Based Volcano Response Plans in Washington and Oregon

- **Mount Hood Coordination Plan:**

<http://www.oregongeology.org/sub/earthquakes/mthoodplanfinal0905.pdf>

- **Mount Baker – Glacier Peak Coordination Plan:**

[http://www.emd.wa.gov/plans/documents/mtbaker\\_glacier\\_coordination\\_plan.doc](http://www.emd.wa.gov/plans/documents/mtbaker_glacier_coordination_plan.doc)

- **Mount Rainier Volcanic Hazards Response Plan**

[http://www.emd.wa.gov/plans/documents/mtrainier\\_volcanic\\_hazards\\_response\\_plan.pdf](http://www.emd.wa.gov/plans/documents/mtrainier_volcanic_hazards_response_plan.pdf)

## Appendix E

### CVO's Mount St Helens "Call Down" List

#### CONFIRMED EVENT

Make calls as brief as possible!

OPS Person	
Or person #1	And person #2
1. SIC (cell) Duty Scientist (cell)  (this person will call-VSC Director (cell) and if necessary VHP Coordinator (cell))	2. Seismic Person (call one) CVO Seismologist PNSN UW Hot Line EW Support (cell)
3. Seattle ARTCC (FAA)  Ask for PIREPs, have them call back on hotline	4. Weather Forecast Office Portland  Ask them to check for plume with NEXRAD, have them call back on hot line (this could take 6-10 minutes)
5. Forest Service	6. WA State EMD
7. Washington VAAC	8. River Forecast Center Portland – hydrology Could the event generate lahars? Notify NWS hydrology and also checks AFMs.
9. FAA Regional Operations Center	10. Air Force Weather Agency (AFWA) (primary or secondary)
11. BC Provincial Emergency Program (PEP) (covers all Canada)	

Remember to call back and keep each group informed of event's progress every 15-20 minutes and when there are significant changes (including termination)

#### SUSPECTED EVENT

CALL 1-6 with "heads-up" and ask for feedback. IF event is confirmed or IF signal is continuing and you still suspect an event, initiate full call down.

#### NEED MORE HELP – USE THE INTERCOM

Note: JIC (24 hour media number)

## Appendix F

### Glossary of Volcanological Terms

**Ash:** Finely fragmented particles of rocks and minerals less than 2 millimeters in diameter produced by explosive volcanic eruption. Ash is a type of **tephra**.

**Ash cloud:** A cloud of volcanic particles, often with gases and aerosols of volcanic origin, formed by volcanic explosion that is carried by winds away from an eruption column. Ash clouds may drift for hundreds to thousands of kilometers from their volcanic source.

**Ash fall:** Fragmental material (tephra) that falls from an **eruptive plume**, **eruption cloud**, or **ash cloud** and is deposited on the ground surface.

**Basalt:** Basalt is a black volcanic rock with less than about 52 weight percent silica. Because it has low silica content, gases tend to escape easily without usually generating large eruptive columns.

**Eruption:** The arrival of volcanic material at the Earth's surface, including explosive ejection of fragmental material and/or the effusion of liquid lava. Includes phreatic eruptions.

**Eruptive plume:** The elongated, downwind dispersed portion of an **eruption cloud** or **ash cloud**.

**Eruption column:** The vertical pillar of ash and gas that forms above an explosively erupting volcano. Columns from energetic eruptions may rise to more than 100,000 ft (30 km).

**Lahars:** volcanic mud (debris) flow.

**Tephra:** The collective term for fragmental materials ejected from craters or vents during volcanic eruptions.

**Volcano:** A vent or opening at the surface of the Earth through which magma erupts; also the landform that is produced by the erupted material accumulated around the vent.